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Fossil handbook (undated -- late 70's??)

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FORWARD:

This field book is intended to guide beginners in their collection and general classification of inverterbrate fossils. It illustrates some of the inverterbrate fossils most commonly found in Maine and relates some to the period of geologic time of which they were a part. A list of publications that will furnish more detailed identification of specimens is included in the back of this book. This book has been prepared in response to numerous requests made to the Maine Geological Survey from amateur collectors.

Information has been drawn from numerous sources. The works of Dr. Robert R. Shrock, Dr. William H. Twenhofel, Dr. William B. N. Berry, and Dr. Arthur J. Boucot have been particularly useful.

I am especially indebted to Mr. ~~Robert G. Doyle~~ Walter A Anderson, State Geologist, Maine Geological Survey; Dr. Arthur Hussey, Jr., Bowdoin College; Dr. Bradford A. Hall, University of Maine; Louis Pavlides, and Dr. Robert B. Neuman, U. S. Geological Survey, Washington, D. C.: and many others who have given generously of their time and who have made many helpful suggestions.

Paleontology is the study of prehistoric life. Evidence of such life is preserved in rocks of the earth's crust in the form of petrified remains or other fossil evidence such as a foot print. Since ancient times man has attempted to learn all that he can about his environment. He has been greatly concerned with the origin and succession of life. Much of this search is centered around the ideas of evolution and extinction as discovered through the study of fossils. The patterns displayed here will help man in the future as will be evidenced by his knowledge, purpose and ethics.

WHY STUDY PALEONTOLOGY?

The answer is a simple one. Man is an inquisitive creature and has probed everything possible to satisfy his curiosity. The satisfaction he gets from increasing his knowledge has carried him to the peak of domination of all other forms of life on earth. Intellectual satisfaction is an educational result and is not necessarily renumerative, though frequently it is both.

A paleontologist finds as much pleasure and relaxation in tramping over hills and thru the woods in search of some rare creature that no man has ever seen before as a fisherman would get by successfully hooking and landing the largest fish ever caught in his favorite lake or stream. Some of the most memorable adventures of my life have come about as a result of going out into the field to collect fossils. On one trip in particular, Dr. Henry Andrews, a well known paleobotonist from the University of Connecticut, Dr. Kenneth Seagroves, also from the University of Connecticut, and myself were collecting fossils along the coast of New Brunswick, Canada, and ended up at sea in a lobster boat on one of the most delightful lobster feeds imaginable.

The greatest value of fossil collecting is the personal satisfaction and pleasure that it affords the individual.

Many youth organizations, Boy Scout Troops, Cub Scouts, conservation groups, 4H'ers, to name a few, go on fossil-hunting trips in the healthy atmosphere of the wide open spaces, ever mindful of the fact that one of their group could make a very important fossil discovery. This frequently happens. Some of the most important fossil discoveries have been made by amateurs. The hobby of mineral and fossil collecting is growing at such a rapid pace that it now ranks second in the nation only to stamp collecting in popularity.

One of the most important objectives of fossil collecting and paleontology of course, is the economic applications. Many of our largest industries depend upon the study and research of fossils for their survival. The petroleum industry for example depends entirely on fossils. Petroleum and natural gas were formed from tiny animals and plants that lived in shallow seas millions of years ago. These seas covered parts of what is land today. The animals and plants died and were covered with mud on the sea bottoms. Later this mud was covered by layers of sand and layers of shells and by layers of sand and layers of shells and by layers of more mud and so on. Millions of years went by. The dead animals and plants decayed and formed gas and oil. The mud formed shale, the sand formed sandstone, and the shells formed limestone. As the earth shifted and twisted it formed pockets for the trapped gas and oil. Millions of years later geologists use the fossils found in the shale, sandstone, and limestone to trace the layers that contain the trapped gas and oil.

Plant fossils associated with coal are used in very much the same way. Our fossil limestone and marble deposits are very important to our industry. These make valuable building stones and some are cut for ornamental use. These were formed from millions of animals that died and were buried on the floors of the ancient seas that once covered this area. Micro fossils are used as filters, fillers in polishes and for many other purposes. Phosphate is associated with large deposits of fossil bones. Fossil resin from ancient trees are fossils used as jewelry.

How are fossils used to trace the strata that harbor these great mineral deposits? In 1799 an English gentleman by the name of William "Strata" Smith announced that he had discovered that sedimentary rocks of the same age always showed the same types of fossils. He went on to demonstrate with proof that the succession of fossils was always in the same order. These studies led eventually to the theory of evolution and great changes in mans approach to the historical aspects of the universe about him.

In addition, these studies led to extensive interpretations of past advances and recessions of the seas on our continents. This is quite natural, since the fossils that we find are animals that lived in the sea and had hard parts, such as shells, that were best preserved in sedimentary materials like mud and silts that were deposited in shallow seas. Since a considerable portion of our continent is covered with sedimentary rocks, these studies have become of practical importance, especially, since as we have said before, accumulations of petroleum occur in such cover rocks.

In addition to their enormous interest to scientists as records of progress of organic life in the past, fossils have been found indispensable in many other areas of geologic research. Fossils make possible a clearer understanding of the earth's history, climate changes and the former distribution of plants and animals in their environment.

No absolute date can be made in geology for certain beds or strata, though calculations have been made by several methods to determine their age, and the duration of the various periods. These ages are dealt with by round numbers.

If one finds a sequence of beds all dipping in the same direction, one knows that those at one end must underlie those at the other because we can trace all the beds in between. Of course, it is not possible here in Maine to find a complete sequence of beds in any one place and it is here that fossils help out. External appearances of the rock are not enough to determine the sequence of beds. But we do know that fossils in a certain bed are younger than those beds below it, and older than those above it. Fossils found in the lower beds gradually disappear as one goes higher and new fossils begin to appear, so that the assemblege of fossils in the upper beds are quite different from those in the lower beds. Every formation is marked by its distinctive assemblage of fossils, and one can therefore identify a formation, no matter when it occurs, or how isolated it might be, by its characteristic assemblege of fossils. "Index Fossils" or guide fossils, are fossils which are restricted in vertical range and represent organisms which lived for a comparatively short period of time only, giving place to later types. Therefore they are satisfactory indexes to a certain period in earth history, serving to identify a particular horizon or formation. Index fossils are very important in identifying the same formation in different locations, and those fossils that have the greatest horizontal, worldwide, or geographic range, with the smallest vertical or time range, are the most valuable.

WHERE TO LOOK FOR FOSSILS:

The question of where to look for fossils is quite easily answered. The best place to look is in sedimentary rocks, for these are the principal rocks that contain fossils. There are exceptions, of course. Fossils have been found in volcanic lavas and metomorphic rocks, but these are rare occurances and usually it is a waste of time for the amateur to spend his valuable few free hours looking for them in this kind of rock. Sedimentary rocks such as limestone, shales, sandstone, are quite common in most parts of the state of Maine, but all do not unfortunately contain fossils. The purpose of this book is to show how to find some of the better localities.

Generally, fresh exposures are the best places to look for fossils. Look at road cuts, railroad cuts, stream banks, and river beds. Another good place is where construction is going on. Excavations for buildings frequently expose good sections of bedrock. Always be alert. Cliffs and road cuts can be very dangerous as loose material overhead can be dislodged and come crashing down with little or no warning. Remember that working alone in these places is not recommended. Also do not throw rocks over the sides of cliffs as they are a danger to anyone below you.

TOOLS FOR FOSSIL COLLECTING:

Tools for fossil collecting should be chosen with care. There are no hard and fast rules for tool selection, but the following are a few essentials and suggestions.

Whatever tools you decide upon here is one mistake to avoid. Do not purchase tools from discount stores as they simply will not do the job and are a constant danger to you and anyone who happens to be nearby. Low priced chisels will chip, and these steel splinters in an eye can mean big trouble. Choose instead a good independent hardware store. The small additional price paid for good tools is well worth the difference.

HAMMER:

A hammer need not be a geologists picktype but one would, under certain conditions, be useful. The best type for working in sedimentary rocks is a common bricklayer's hammer with a chisel blade on one end. Care must be taken to keep the chisel fairly sharp.

CHISELS:

An assortment of chisels are needed to separate the rock layers and extract the fossils from the rock. Usually a couple of small ones, one medium size, and one large chisel will be sufficient. Also, if room permits, the addition of a prybar of some sort is most useful. I have found an ordinary carpenters pinch bar to be quite satisfactory.

KNAPSACK:

This should be of a sturdy type but it is not essential. Any cloth bag to hold specimens and tools will do. Some people find a stout shoulder bag will work just fine. Paper bags do not seem to work very well on rainy days!

WRAPPING MATERIAL:

Fossils are very fragil, so a good supply of newspapers or other suitable wrapping material is essential. Be sure to have plain paper with which to make a label to be wrapped with each specimen. The label should include date, location, and formation. Mahy fine specimens have been rendered worthless because the collector has failed to properly label his specimens and cannot remember exactly where the specimen came from. Remember, a fossil or any mineral specimen is valuable only if it is properly catalogued.

LENS:

A small folding hand lens is helpful to see tiny fossils in the field and again this need not be an expensive one. Almost any magnifying glass of 4-10 power will do.

NOTEBOOK AND PENCIL.

COMPASS:

Perhaps the most important single item in your kit will be a good, reliable compass and the knowledge of how to use it. It is a real temptation when out in the field collecting fossils or minerals on a fine day to wander around looking at trees, hunting mushrooms or just plain daydreaming, as I have frequently done, and find yourself far from where you started. The Maine woods is a big place and can be your friend,but not without a compass!

CLOTHING:

For personal comfort a good stout pair of boots are most essential. You will be walking over very rough terrain and it is very easy to turn an ankle. This can be disasterous if you are alone in the woods. Also, it is no fun to hike several miles with a heavy pack and have blisters on your feet.

MAPS:

Have a good supply of maps of the area that you intend to collect. These can be road maps or a geological survey topographical map that can be purchased locally at most sporting goods stores. Remember, the greater the weight of equipment, the smaller the load of rock that can be carried back.

RULES OF COURTESY:

When entering a collecting area every collector should observe several rules carefully.

1. For your own protection get permission to enter and collect on private property. Such action will help to assure your welcome if you wish to come back again.

2. Do not climb fences that will sag or break under your weight; crawl under or go around.

3. Keep the area clean. Don't litter. Be sure that lunch wrappings and newspaper wrapping materials are not left lying around when you finish.

4. Do not disturb owners buildings or equipment, and be especially careful of all planted areas.

5. Do leave material for others that come along behind you to collect. Take only what you need.

HOW TO COLLECT:

When you arrive at the locality where you want to collect, take time to look over the whole area carefully. Do not be in a hurry to start collecting at the first sight of fossils. When I first started to collect, I began the moment I arrived. After I had spent all of my time in one spot I found that the best places were located only a short distance away, often only a few feet, and I had to be content to only look and take my leave. Turn over rock fragments and look them over very carefully on all sides. Look for weathered surfaces that have exposed fossils. Try to distinguish bedding surfaces, and if it is necessary to break open the rock, do so with a chisel parallel to the bedding. In some types of sedimentary rock you can break the rock at right angles to the bedding plane and hack away until doomsday and not see a fossil, when in truth fossils are abundant on the bedding surfaces. This is especially true when collecting plant fossils and graptolites. It is advisable to wear protective goggles or nonbreakable glasses during this operation.

Again, this caution. The fossils you have collected will be worthless if you fail at this point to carefully wrap and insert a label in the wrapping. Take care not to let your hard work be for naught.

Counterparts of either compressions or impressions, if they are well preserved, should be kept along with the originals. These reverse impressions will often show details not seen or preserved on the originals.

FOSSILS AND THEIR PRESERVATION

WHAT ARE FOSSILS AND HOW ARE THEY PRESERVED?

Fossils are the remains of plants or animals or the physical record of their presence in prehistoric times. Some definitions narrow this by stating that a fossil must be found preserved in the rock of the earth. Other workers broaden the defination by including early man-made tools that predate written records. The first definition is more generally accepted.

HOW ARE FOSSILS FORMED?

When an organism dies, iteither vanishes completely or leaves a record of its existence. Those that leave a record do so as a result ofvarious physical processes. The types of fossil remains can be divided into two main classes-unaltered remains and altered remains.

Uncounted trillions of plants and animals have lived and died during the billion or more years that life has been on earth. A relatively small number with hard parts suitable for preservation have found themselves in a position which resulted in their fossilization. By far the most abundant were pollens, spores, and the shells that settled to the bottoms of the ancient seas that once covered this area.

UNALTERED REMAINS

Unaltered remains are remains of organisms that have become fossilized with little or no change.

DRYING:

Lack of moisture eliminates or slows down the decaying process as in a desert environment. Some animal fossils have been found in mummy-like condition in caves.

ENCASEMENT:

Animals and insects that have been trapped in tar pits or encased in resin of trees are examples of encasement. In many cases the animal has been sealed off from the decaying process for millions of years and found in an unaltered condition.

FREEZING:

In many parts of the world animals that have been dead many thousands of years have been found preserved in frozen soil and ice. Some of the wooly mammoths have been found in Siberia and in such a perfect state of preservation that the natives have fed meat to their dogs.

ALTERED REMAINS

PETRIFICATION (Turned to stone)

As water percolates through hard parts of organisms, minerals dissolved in the water may be deposited in the spaces of the body. These minerals, upon hardening, usually retain the original shape of the organism. Petrified wood is a good example

DISTILLATION:

If the plant or animal is buried quickly in fine sediments, the volitle organic materials are distilled out, leaving a residue of carbon. This carbon film often shows details of fossils that are usually lost in fossils that are preserved in some other way. Some unique plant fossils have been found preserved in this way.

COMPRESSIONS: These fossils are best explained in fossil plants that have been buried in mud or sand of stream beds, lakes or lagoons. The mud and sand became shale and sandstone and the plants were compressed into coal.

IMPRESSIONS:

When a fossil shell or plant is buried in soft sediment such as mud, the surrounding silt settles tightly around it. If the fossil is removed it can be seen that the sediment has made a perfect mold around its external surface. This is an external mold.

MOLDS AND CASTS:

An external mold, then is the hardened imprint of the exterior part of an organism. An internal mold is formed from sediment that fills the inside of the organism (a shell, for example) and hardens. If the covering material is worn away, the internal mold will remain. A cast is made by filling the impression of the external mold or covering an internal mold. The original body is destroyed in both casts and molds.

PSEUDOFOSSILS:

Pseudofossils are inorganic remains that resemble the appearance of fossils. Decaying vegetable matter sometimes leaves a stain on rocks that resembles leaves or plants. Denderites (from the Greek Dendron, a tree) are often mistaken by the uninitiated for fossil ferns or mosses. They are branching mineral encrustations, formed usually by manganese oxide or pyrite, and are found as surface markings, along cracks, or enclosed in the rocks.

Another commonly mistaken pseudofossil is called "slickensides", which in some cases resembles fossil stems of plants. The distinction is easily made, however, for fossils of plants are always found on surfaces parallel to the bedding plane of rocks, while the "slickensides" are nearly always at right angles to the bedding plane. Slickensides are produced when movements within a rock mass cause one rock face to move against another, as one might find along a fault plane.

The term "fossil" can be extended to inorganic objects as well as organic. The word can conveniently be used to describe such things as fossil ripple marks, mud cracks, and rain drops along with tracks, and burrows.

CLASSIFICATION

Organisms are classified into two great kingdoms, the plant kingdom and the animal kingdom. These are in turn divided into successively smaller and more restricted groups by a system of order that tries to divide generally similar groups into categories with more specialized similarities.

There is still disagreement among paleontologists and biologists over the division of life into plants and animals as there are many exceptions to each. Some of the basic definitions of the separation of animals and plants are these: the cell membrane of plants secretes a hard protective covering called cellulose; an animal cell does not.

Another distinction is that a plant manufactures its food by photosynthesis, an animal does not. An animal must get its food by eating other organisms. As has been mentioned before, there are exceptions to each. Vertebrate animals have back bones, invertebrate animals have none. The classification of animals and plants into their respective phyla classes, orders, family, genus, and species is based generally on the form and structure of the soft parts, complexity of organization and the nature of the hard parts. Some fossils have great difficulty in being assigned to the proper place in this order because their soft parts have not been preserved.

The following is the classification of the organisms that one will most likely encounter in the collecting localities of Maine. The listing and discription is in the order of increasing complexity.

The Invertebrate Fossils

1. Protozoa
2. Porifera
3. Coelenterata
4. Bryozoa
5. Brachipoda
6. Mollusca
7. Arthropoda
8. Echinoderma
9. Chordata

1. PROTOZOA (Greek Protos, first; zoon, animal)

The phylum protozon includes the simplest and most primitive of the animals and comprises both marine and fresh water organisms composed of a single cell or a small number of undifferentiated cells. Only two orders of one class are likely to be found as fossils, the forminifera and the other radiolaria. Both of these orders are very small, 1 millimeter or less in diameter, but when they are found they occur in great numbers. These animals are quite important as rock builders as they excrete an external shell composed of lime (calcium carbonate) and these shells, settling to the bottom of some of the fresh water lakes, have formed thick layers of lime that has been utilized as agricultural lime, used in industry as filters and polishes for example. They are mostly marine are known in all periods from the precambrian on.

COELENTERATA (Greek Koilos, hollow; enteron, intestine)

Coelenterata are simple animals which include jellyfishes and corals. Their bodies are radially symmeterical and usually have tentacles. The coelenterates represent the lowest order of animals having tissues. The individuals may be either solitary or colonial in habit. Only the coral member of this phylum will be discussed here, as it is the only one that commonly will be found as a fossil.

Corals represent the class ANTHOZOA (Greek anthos, flower; zoon, animal). It derives its name from when the polyp has its tetacles extended. It has a flower-like appearance.

The animal consists of a cylindrical body with a circle of tentacles surrounding the mouth, which is located at the open end. The stinging tentacles are utilized by the polyp to paralyze small crustaceans, worms, and other marine organisms on which they feed. The food is pushed into the mouth, which is a sac-like stomach cavity, and there it is digested. All waste is expelled back out of this same mouth. Each polyp builds around itself an exoskeleton of a calcareous or chitinous nature called a corallum. Some corals build a solitary exoskeleton and these are usually known as the horn corals. Others join one exoskeleton to another and forms though and make up a considerable portion of the calcarious mud or "ooze" in the ocean bottoms. Protozoans first made their appearance on earth long before the cambian period. (570-500 million years ago)

PORIFERA (Latin porus, pore; ferre, to bear)

The proifera, or sponges, derived their name from the fact that they take in food not from a single mouth but through many small pores scattered over the surface of the body. The food is discharged through the osculum, a large opening at the top of the animal. The body of the organism is composed of three layers, an outer layer of protective cells (the ectoderm), an inner layer of cells that are the food digesting cells (endoderm), and the middle layer of a non-cellular jelly called "mesagloea". This middle layer secretes web-like structures of filaments called spicules that support the body of the animal. These specules, which are composed of silicia, are the parts that will in most cases be found as fossils. The limestone found at Square Lake, Maine, when dissolved in acid yields great quantities of these specules.

Sponges usually are colonial; they live together as a colony. Most sponges will be found living today in the shallower parts of the ocean. Sponges form a colony. The shape, wall structure, and architecture are some of the identification features used to identify corals. Reproduction is either asexual or sexual. Individuals formed by budding remain a part of the parent, thereby helping to build the colony. Those individuals reproduced sexually emerge as free swimming larva that settle to the sea bottom and develop into new individuals.

Corals are marine animals that favor shallow warm waters. There are exceptions of course, in that a few species are found in fairly cold waters quite far north. Scientists, by studying the living corals found in the oceans today, have been able to learn much about the climates and the environments of these organisms in the past. Anthozoas began evolving in the precambrian and are still abundant in the seas today.

HORN CORALS:

The horn corals are representatives of the subclass tetracorallia, or more commonly "rugosa", because of its rough exterior. The common name "horn coral" is derived from its resemblance to the horn of a cow. Horn corals lived as individuals. They are frequently encountered in Maine rocks as fossils and some are quite well preserved. The horn coral evolved early in the Ordovician Period and became extinct toward the end of the Permian period. The zenith of the horn corals was during the Silurian and Devonian periods when they were the most abundant.

TABULATE CORALS:

This suborder includes two of the most frequently encountered of the compound corals; the honeycomb coral (Genus, Favosites) and the chain coral (Genus, Halysites). These extinct, exclusively Paleozoic animals are characterized by the horizontal layers that extend between the walls of the skeleton and are called "Tabulae" from whence the suborder derived its name. These tabulae, or floors within the walls of the skeleton, were secreted by the animal as it moved upward from the sea bottom.

HONEYCOMB CORAL:

The honeycomb appearance of weathered specimens is easily recognizable in the field. The shape can be branched, round, and massive, measuring from a few inches to a foot in diameter. Each segment in the fossil is the protective container or exoskeleton of an individual polyp or animal. The geologic range of the genus Favosites is from the Ordovician through the Permian.

CHAIN CORAL:

The chain corals belong to the same suborder as the honeycomb corals. This genus, Halysites, is characterized by the oblong or sub-rounded shaped skeleton of the individual polyp which, joined together with its neighbors, give the speciman a chain-like appearance. This fossil in Maine is known from the upper Ordovician through the Silurian and is a good index fossil for the Paleozoic.

BRYOZOA (Greek, Byron, Moss; zoon, animal)

The bryozoans are small marine or fresh water animals, nearly always occuring in colonies. They construct a large variety of branched structures from a fraction of an inch to several inches in length. The Greek word moss animal aptly describes these animals, as their colonies spread exquisite growth patterns of stems, fans, fronds, and open-meshed lace work forming delicate encrustations over shells, stoves, and the sea bottom. These animals frequently attach themselves to some foreign object or to the sea bottom by root-like appendages. It is quite common to find them as fossil incrustations on other fossil shells.

The animal itself called a "polypide" secretes an external supporting tubelike structure composed of calcium or chitin called a zooecium. The complete colony when joined together is known as "zoarium."

In general, reproduction of individual zooids is carried on by "hemaphroditic" parents. New colonies develop from a free swimming larval stage that settles itself on the bottom and secretes a tubular structure around the body. By repeated budding from the first polypide, and later from the others, a colony begins to form. This budding can take many different shapes, resulting in a great variety of colonies.

Bryozoans are known from the Ordovician to the present time.

BRACHIOPODA (Greek, Brachion, arm; Pous, foot).

Brachiopods or "lamp shells" are strictly marine bivalves. They consist of two bilaterally symmetrical valves that are dissimilar in shape and enclose the soft parts of the animal. The shell is generally composed of calcium carbonate. The phylum consists of two classes, based on the union of the two valves, the articulata and the inarticulata. In the former, the two valves are joined together along the hinge-line by a system of tooth and sockets. In the inarticulates the valves are held together solely by a well-developed muscle system. The two valves in addition to being dissimilar in shape are also unequal in size. The larger of the two is the pedicle valve.

The interior of this valve houses the pedicle, a fleshy stalk held to the interior by muscles. The pedicle protrudes through an opening and is used by the animal to attach itself firmly to the ocean floor.

Brachiop ods are certainly one of the most common of the marine animals found as fossils. They were apparently able to adapt to a great number of different environments and are found in nearly all types of sedimentary rocks.

Brachipods are known as fossils from the precambrian to the present time. They are also noteworthy for their great numbers and almost endless variety. Brachiopods, because of their rapid evolution in some genera and their worldwide distribution, serve as excellent index fossils.

PHYLUM MOLLUSCA (Latin Mollis, soft)

The phylum mollusca is treated here in only the classes pelecypoda, gastropoda, and cephalopoda, as these will be the members most likely found in Maine.

CLASS PELECYPODA (Greek Pelekys, ax; pous, foot)

This class is composed of one of the largest groups of mollusks. It includes many of the familiar animals that are very important to man. These include the clams, oysters, and mussels. The pelecypods are either fresh water or marine mollusks which have a calcareous shell of two halves. Unlike the brachiopods, the pelecypod shells are usually mirror-images of each other, even though each valve by itself is not symmetrical. For example, you cannot cut a single pelecypod shell into two matching halves. Again, unlike the brachiopods, the shells of pelecypods cover the sides of the animal instead of the top and bottom as with the brachiopods.

The fossils of these animals can be found in nearly all kinds of rock that contain fossils, but are not nearly as common as brachiopods.

Pelecypods are known from the Lower Ordovician rocks to the present time. Their value as index fossils is limited because of their generally poor preservation. At least this is the case of the fossil specimens found in Maine.

CLASS GASTROPODA (Greek gaster, gastros, stomach; pous, foot)

To this class belong the snails and slugs, among others. They are single valved or univalved mollusks, and are marine, fresh, water or land animals.

The fossil remains of this group of marine animals are not common in the rocks of Maine, but the collector should be able to recognize them when they do occur.

The oldest known gastropods are found in the Lower Cambrian and continue through to the present.

CLASS CEPHALOPODA (Greek kephale, head; pous, foot)

The living cephalopods include squids, cuttlefishes, octopuses, and constitute the most advanced class of the phylum mollusca.

Cephalopods have soft bodies, tentacles surrounding their mouths, and many have well developed eyes like our own. Some were strong swimmers and others crawled along the ancient sea bottoms. Most had shells, although few cephlapods living today have shells.

The fossil cephlapods that you will find in the rocks of Maine all lived in a chambered shell. The shell is shaped very much like an ice cream cone. Usually these are in a much-flattened state, but are readily identified as fossil cephalopods. The rocks that contain cephalopods must have been formed from sea sediment, since cephalopods dwell only in the sea.

Cephalopods are known from the Cambrian to the present. Generally, all of the cephalopods found in Maine rocks are poor index fossils.

PHYLUM ARTHROPODA (Greek arthron, joint; pous, foot)

This phylum comprises a very large and varied group of invertebrates with a long history that goes back to the Pre-Cambrian.

The body of the animal is encased in a protective chitionous exoskeleton. All arthropods are characterized by externally jointed legs, from which the phylum derives its name. Usually their bodies are elongate, segmented, and divided into three parts or sections; head, thorax, and abdomen, and are bilaterly symmetrical with the mouth and anus located at opposite ends of the body.

In this phylum are included the lobsters, crabs, spiders, insects, trilobites, and ostracods. Only two groups will be considered here, the trilobites and the ostracods, as these animals will comprise the bulk of the fossils found in Maine.

CLASS TRILOBITA (Greek treis (tri), three; lobos, lobe)

This class represents a fairly common fossil group that has been extinct for nearly two hundred million years. The animal is covered by a shell or exoskeleton composed of chitin and divided into three parts, or lobes. The middle or axial lobe are two distinct grooves running down the back. These serve to divide the animal into three lengthwise sections or lobes. It is from these three lobes that the animal gest its name, tri-lobite. The head (cephalon), thorax, and abdomen (pygidium), a pair of compound eyes may sometimes be seen in the head. Most fossil trilobites will be found as separated parts, as the animal is believed to have molted or shed its shell periodically as the animal grew.

It is these molts that probably represent the large number of fossil trilobite fragments found in the rocks.

Trilobites began evolving in the Pre-Cambrian and reached the peak of their development in the Ordovician and then began a decline and extinction by the time of the Permian period.

SUBCLASS OSTRACODA:

Ostracodes are minute crustaceans having a calcareous bivalve shell that completely encloses the segmented body. The shells are small, ranging in size from less than 1 mm. to large specimens 20 mm. long. Living ostracods are found today both in fresh water and in marine environments. Osteracods, like all crustaceans are scavengers, feeding on the flesh of dead animals. These small fossils will be quite frequently encountered in the field. This is where frequent use of your hand lens will be indispensable.

Osteracods have been abundant from the Early Ordovician to the present time. They are good index fossils, particularly the Paleozoic forms.

PHYLUM ECHINODERMA (Greek echinos, spiney; derma, skin)

Of the many classes that make up this phylum, including starfish, sand dollars, sea cucumbers, sea urchins, and sea lilies, only the sea lilies will be discusses here. This class will be the one most frequently encountered.

CLASS CRINOIDEA (Greek, krinon, lily; eidos, like)

Although they are animals, crinoids, or sea lilies as their name implies, resemble flowers. They have long stalks, a crown capped with many feather-like branching arms and they grow in great gardens attached by root-like appendages to the ocean floor. It is little wonder crinoids are called sea lilies!

When crinoids died, they usually came apart very quickly. For this reason, complete fossils are rare. The parts most commonly found in rocks are pieces of the stalks, consisting of small sections or tiny button-like discs. The crinoids were important as rock builders. In some areas are found large limestone deposits composed mainly of crinoidal debris. Crinoids developed in the Lower Ordovician and are still living.

SUBCLASS HEMICHORDATA

CLASS GRAPTOZOA (Greek graptos, written; zoon, animal)

Graptozoans, or graptolites (Greek graptos, written; lithos, rock) as they are commonly called, are an extinct group of coral-like animals. The graptolites are most typically preserved as black, carbonaceous films resembling a pencil mark or a small saw blade in the rock. This very interesting fossil derives its name from the resemblance to hieroglyphics or writings on the rocks. A graptolite was a marine organism that built small, colonial exoskeletons of chitin that consists of one or more branches. Along these branches (stipes) are arranged a series of cups (thecae). Within these cups lived the separate individuals. The colony of individuals (rhabdosome) reproduced and grew by budding. Some of the graptolites were branched into irregular bushlike colonies that were known as dendroid graptolites. By a system of crossbars the branches were united to produce a netlike structure. This form is quite often mistaken by collectors for inorganic denderites.

PREPARATION OF SPECIMENS:

The preparation and cleaning of specimens should only be attempted at home after the specimens have been collected. The delicate job of cleaning and removing the specimen from its rock matrix is best done with the proper tools. The following is a list of tools and equipment that will be helpful in the cleaning and preparation of your specimen.

GLUE:

Household glue (Elmers) is perhaps the best as it hardens fairly rapidly and is colorless when dry. Specimens that are accidently cracked should not be discarded, unless the broken pieces are very small or are unavoidably scattered and irretrievable. They can usually be adequately mended with ordinary glue or household cement. If the specimen is broken in the field the broken portions should be labeled as parts of one fossil for subsequent repair at home.

NEEDLES:

You will need a good assortment of needles of various sizes. Good, strong, sturdy ones mounted in a wooden handle are best

DENTAL TOOL:

If it is possible to obtain from a dentist some of his broken dental picks these will be most valuable additions. These are made from an excellent grade steel and will greatly help with the removal of some of the stubborn grains of matrix and for cleaning out some of the grooves and small cavaties.

CHISELS:

Chisels of various sizes and shapes will be found to be very useful. When using a hammer and chisel on a specimen one should be careful to place the specimen on a small bag filled with sand. This serves to absorb the shock and reduces the possibility of breaking the specimen.

ACID:

Occasionally it will be desirous to dissolve away the outer layer of a fossil shell to expose some or all of the interior features. This will be the case with many of the brachiopods. The best chemical to use is a dilute solution of hydrochloric acid (HCl). Approximately a 10% solution will be sufficient.

PAILS:

Inexpensive plastic pails make good non-corrosive receptacles for acid solutions. Place the specimen in one of the plastic mesh baskets that fresh strawberries are packed in at your local supermarket. Place the basket in the acid and frequently check the progress of the solution. Some fossils will disintegrate completely if left too long in the acid bath. Others can be safely left for several days. Experience will soon guide you in developing the proper technique. It is best to experiment with a small sample first.

CATALOGUING:

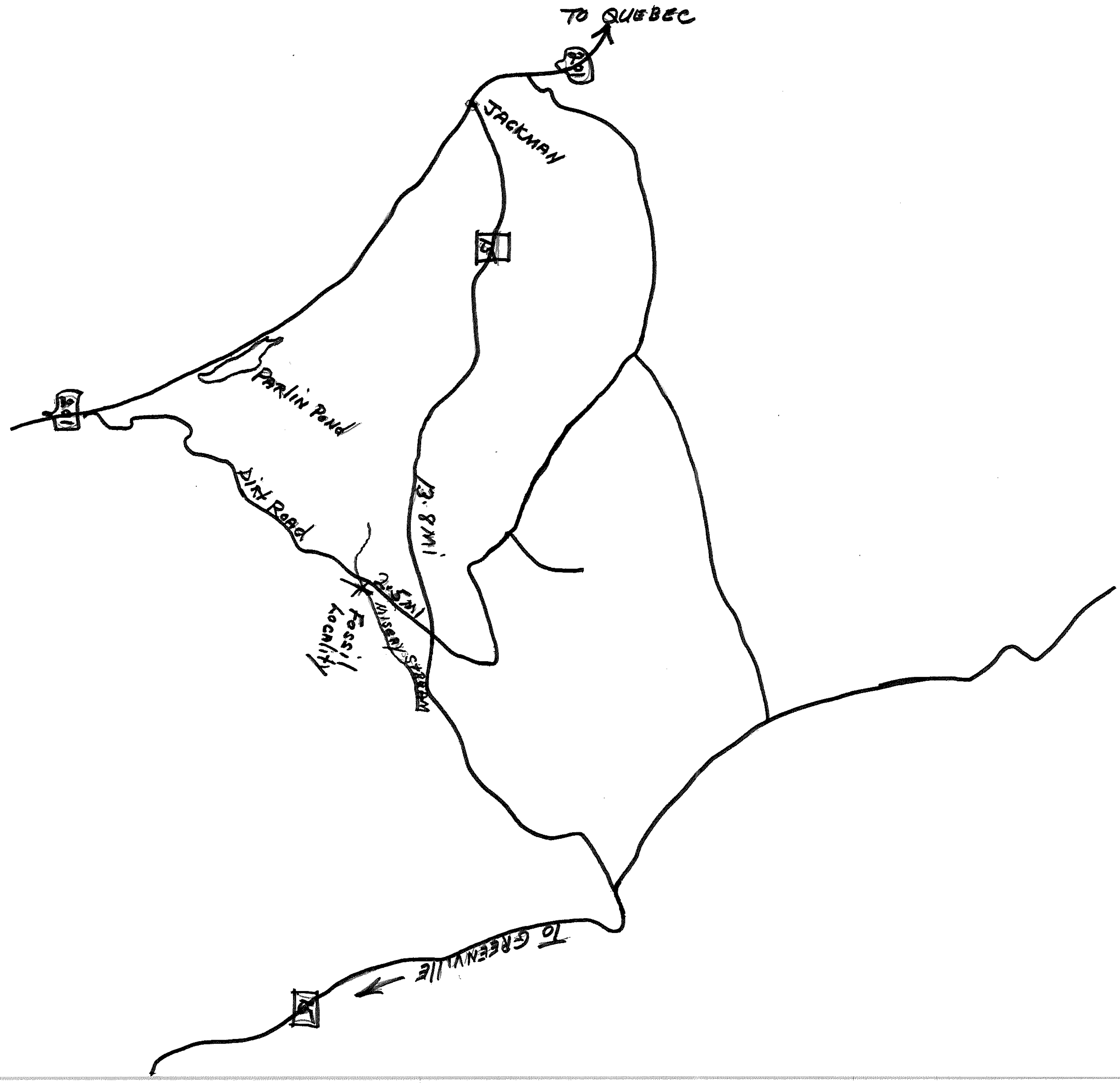
After your specimens have been cleaned and trimmed to your satisfaction the next important step will be to insure that the fossil is properly labeled. There are several ways in which to do this. You may elect to paint the number on the specimen or glue a piece of paper on it containing a number. The latter is generally the least satisfactory. The best method to use is one of the quick-drying enamel paints (white). Select a spot on the specimen and paint a small square in an inconspicuous place and let it dry thoroughly. Next, use a fine point pen and India ink and write your catalogue number on the painted surface.

Your selection of a cataloguing system will depend upon what you personally find most satisfactory. Some like to have an ascending order of number, e.g. 1, 2, 3. Others have used a combination of alphabet letters and numbers. This writer prefers a system of assigning each locality a letter and number combination. For example, A-1 thru A-99, B-1 thru B-99 through Z. I also skip the letters of the alphabet that resemble a number or another letter. This prevents the mistake of confusing a C for G or say an i for an L or 1. Next, the specimens from each locality is given a corresponding number, so that a specimen from Chapman might become A-10-141-F. The letter F at the end of the number sequence indicates the collectors name, Forbes.

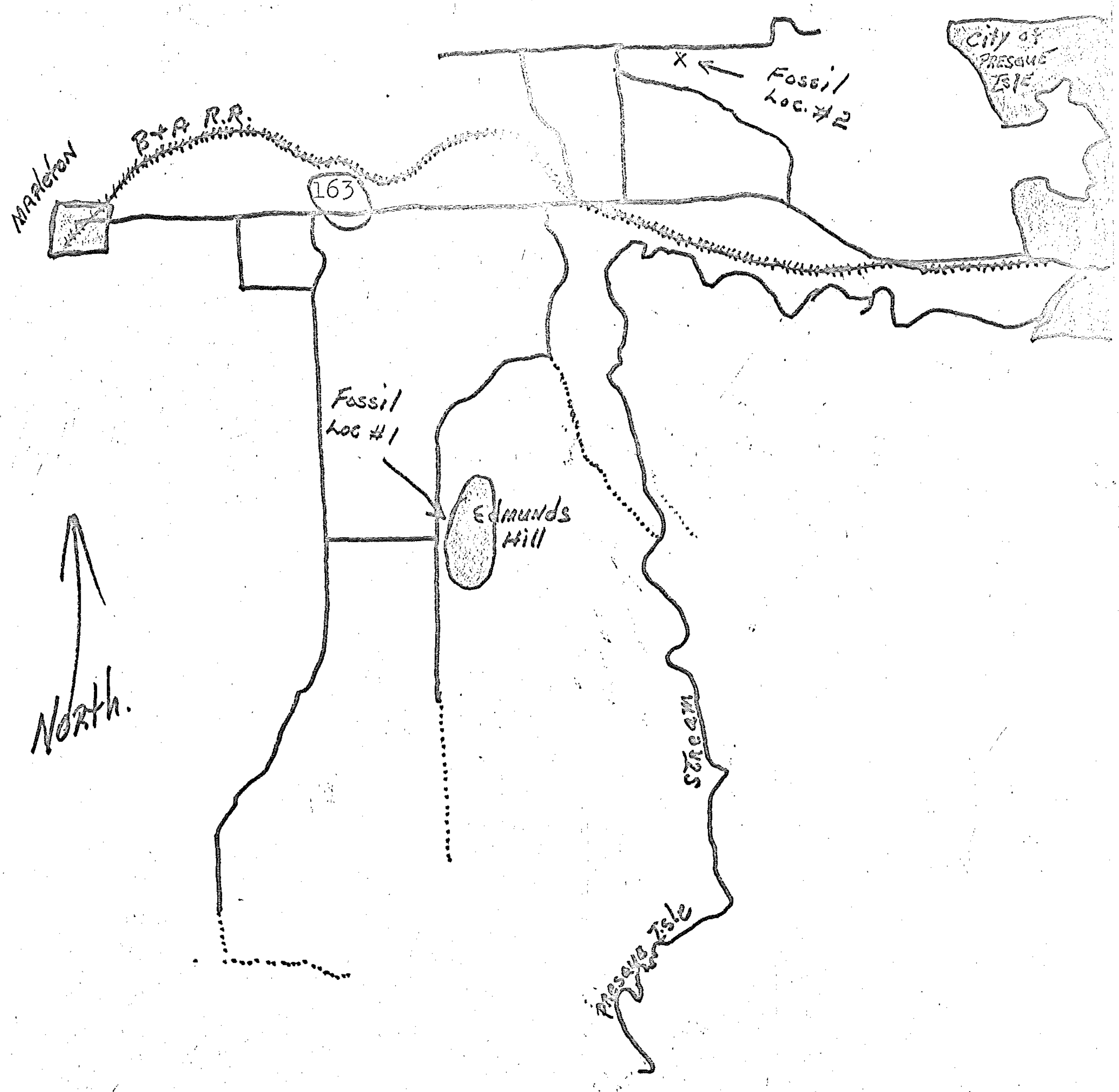
The next step is entering this information to a permanent file system of some sort. An ordinary 3x5 index card works nicely. On the card is noted the locality number, the specimen number, date collected and the collectors name. The name of the fossil, the formation it was collected from, and the precise location from which the fossil came should also be noted at this time. After these steps have been carefully taken you then take out your map of the area and proceed to note the location of the collecting area on the map, using the same locality number that you used on your specimen and file card. In this case we will use the same number we used above for Chapman, A-10. Now you will have a complete record of your specimen and these precautions will result in a valuable collection as time goes by. Scientifically a poorly curated collection is valueless.

(Include diagram of Index card)

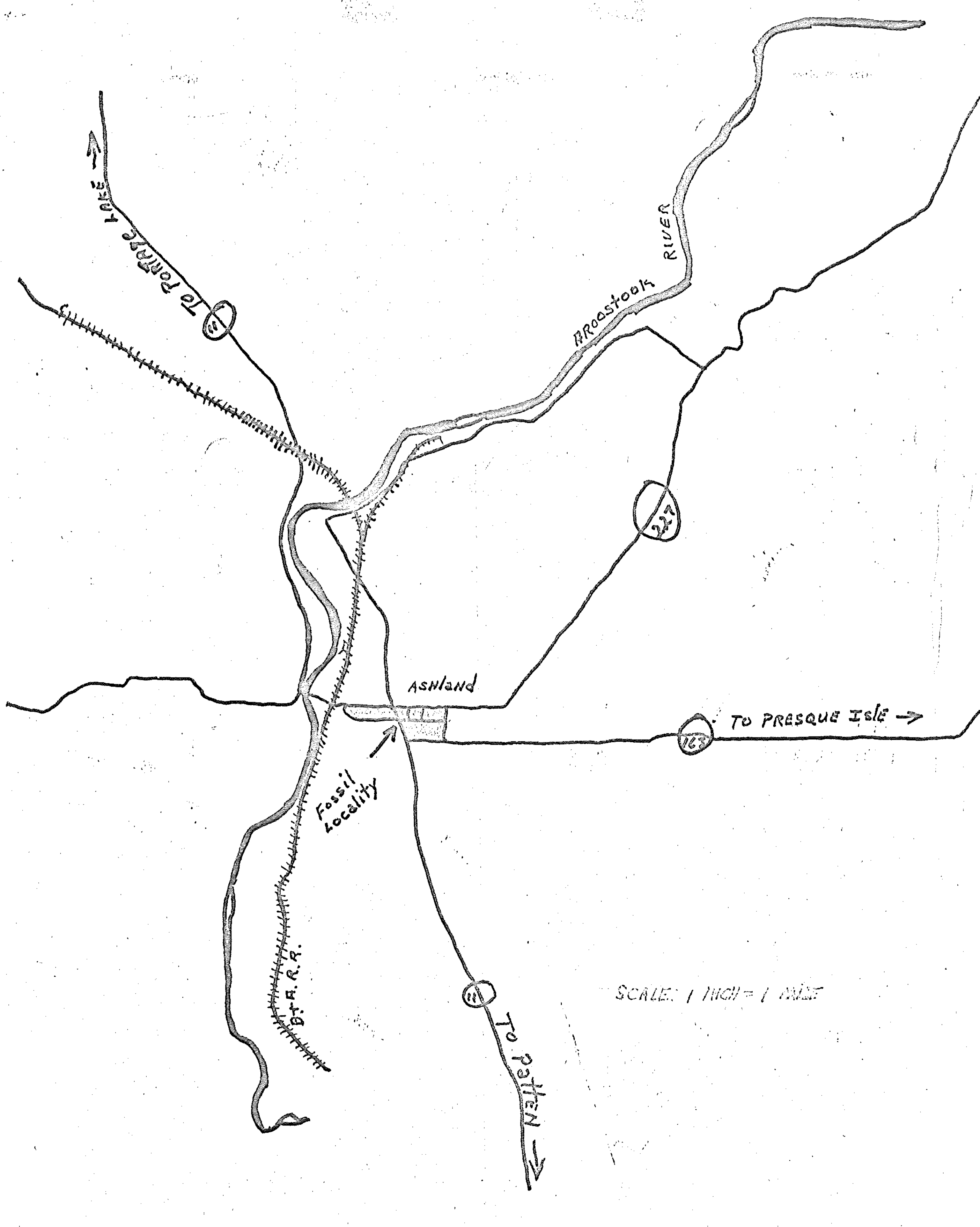
(Include diagram of specimen with label painted on)

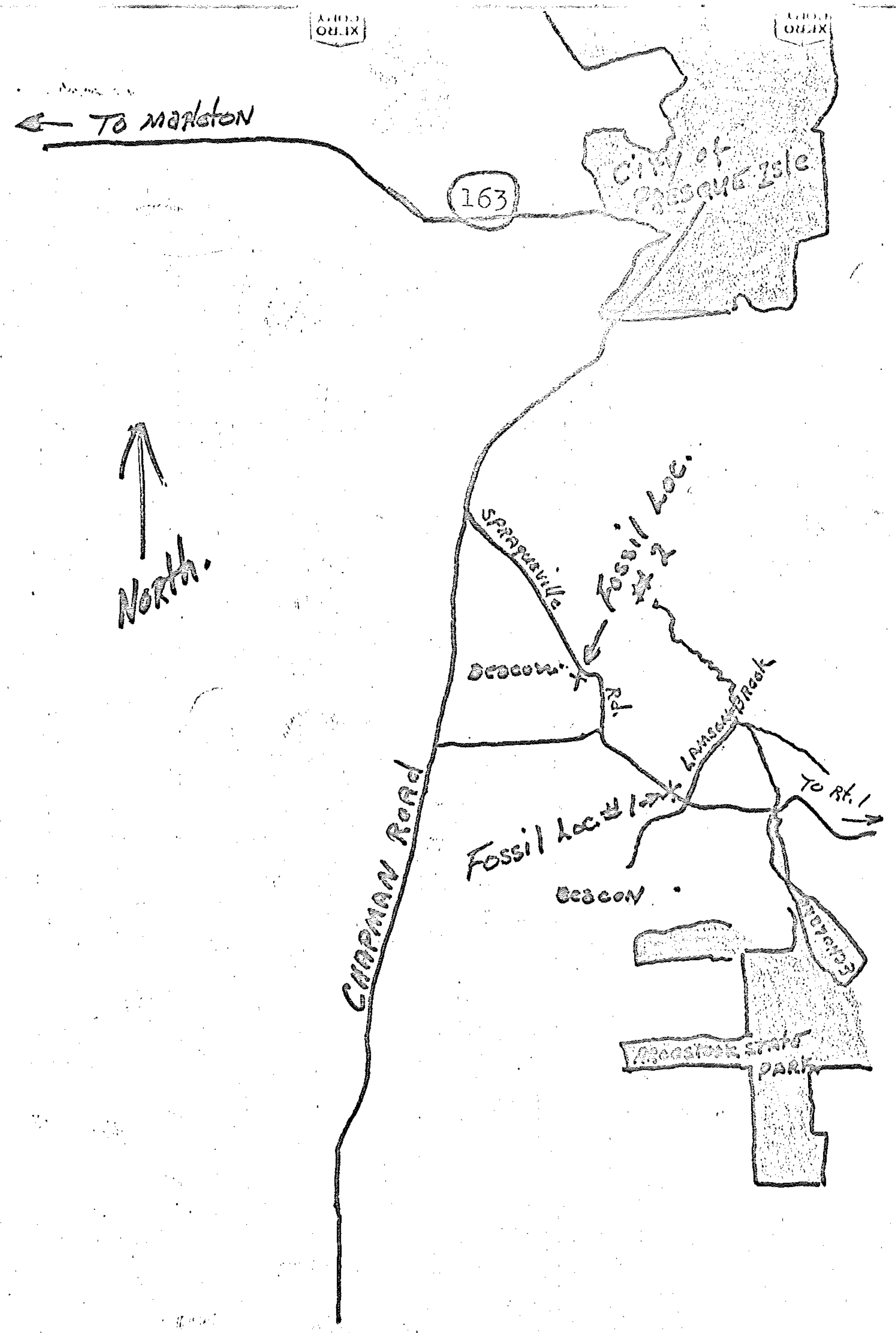


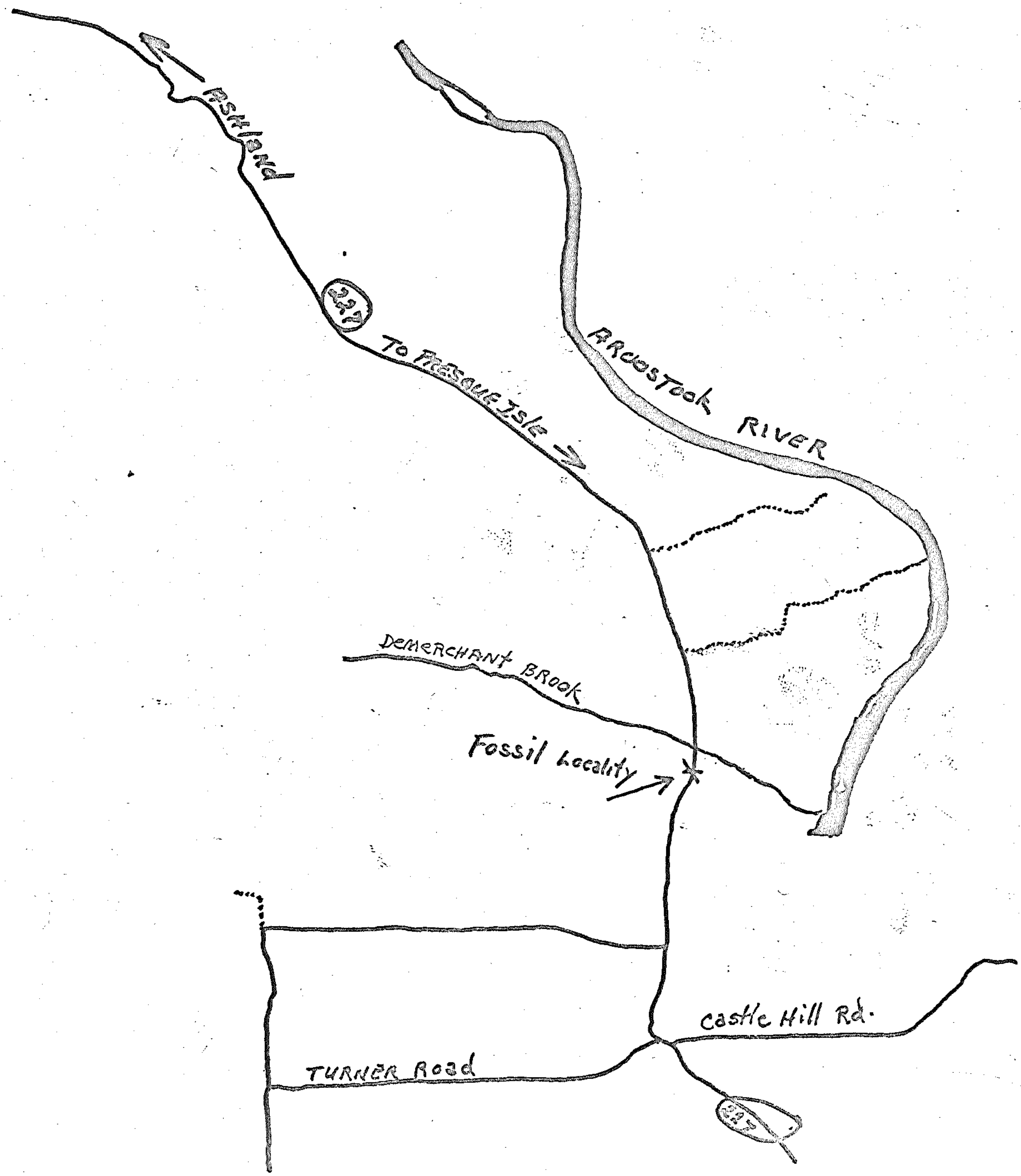
TO QUEBEC
201
JACKMAN
15
Parlin Pond
Dirt Road
13.8 mi
2.5 mi
Misery Stream
Fossil Locality
To Greenville
15
201



City of Presque Isle
Fossil Loc. #2
B+A R.R.
Mapleton
163
Fossil Loc #1
Edmunds Hill
North.
Stream
Presque Isle


To Portage Lake
11
Aroostook River
227
Ashland
To Presque Isle
163
Fossil Locality
B.&A. R.R.
11
To Patten
SCALE: 1 INCH = 1 MILE


← To Mapleton
163
City of Presque Isle
North.
Spragueville Rd.
Fossil Loc. #2
Beacon
Chapman Road
Fossil Loc. #1
To Rt. 1
Beacon
Aroostook State Park


ASHland
227
To Presque Isle
AROOSTOOK RIVER
DEMERCHANT BROOK
Fossil Locality
Castle Hill Rd.
TURNER Road
227

SPRAGUEVILLE ROAD

LAMSON BROOK. Locality #1

The Lamson Brook graptolite locality is located approximately 4miles south of the city of Presque Isle on the slight rise a few feet north of Lamson Brook can be seen a roadside exposure of orange weathering tan shale belonging to the Perham Formation. The following fossils have been collected from this locality:

Monograptus forbesi (Berry)
Monograptus colonus

Monograptus dubius

Monograptus scanicus

Many caphalopods

This outcrop extends from the roadside to the road-side to the roadbed. As this is an unpaved road, the ledge shows up rather micely in the middle of the raad, however the authorities take a dim view towards creating great potholes in the road by removing large pieaes of rock!

Locality#2

Locality #2 is the same as #1 except this locality has a shelly fauna in addition to the graptolites. Also this outcrop has produced monograptus bohemicus (barrande) Trilobite fragments as well as brachiopods are quite abundant . Strewn throughout the fields and rock piles all along this road are enormous quantities of rocks that are fossiliferous. The ledge is close to the top of the ground and repeated plowing of the fields have turned up a good supply of rocks. The age of the rock is Lower Ludlow (Upper Silurian) Perham Formation.

Topographic map to use, Presque Isle Quadrangle.

It may be added here that Aroostook State Park is nearby and there are excellent camping facilities with a good beach front for swimming. If one tires of fossil collecting the fishing is also good at Echo Lake. Be sure to bring along a fishing rod. Trout fishing in Maine is still the best in the world!

JACKMAN

From Jackman go east 13.8 miles to intersection of Scott Paper Co. road.,turn right, continue 2.5 to the outcrop on the left side of road. The bedding is nearly vertical and abundant fossils will be found on several of the bedding surfaces. Some of the fossiliferous layers are 5 to 6 inches thick. The bank on the right side of road is worth checking as some of the large blocks are well weathered and have produced some fine fossils. Some of the fossils found here are:

Brachiopods

Antispirifer Harroldi (Williams)

Leptocoelia flabellites (Conrad)

Chonites sp.

Pelecypods sp.

Trilobites sp.

The age of these fossils is Oriskany (Lower Devonian) and the name of the formation is the(Tarratine Formation)

This is one of the localities that yield some excellent fossils when the fresh blocks are soaked in a dilute solution of hydrochloric acid.

A more thorough search of the out crops in this area will undoubtely reveal more collecting sites.

Portage Lake

From the town of Portage go north on route 11, 3/4 of a mile to the t op of the hill. On the west side of the road can be seen a quarry. The exposures in this quarry are the Winterville Volcanics interbedded with black slate. On the bedding surfaces of this black slate are graptolites of Middle Ordovician age. The following assemblage may be collected:

Climacograptus bicornis (Hall)
Dicranograptus ramosus (Hall)
Dicellograptus sp.
Othograptus sp.

Map to use: U. S1 Geological Suryey Toptgraphic map Portage Quadrangle.

DEMERCHANT BROOK

The Demerchant Brook graptolite locality is a roadside exposure northeast of the town of Ashland, Aroostook County. Take route 227 east from Ashland and follow the road 9/4 miles to Demerchant Brook. The exposure is located approximately halfway up the hill on the east side of the brook. Be sure to park any vehicle well out of the way of traffic as the visibility is poor.

The locality is a part of the Perham Formation, and is a thinly bedded, slightly micaceous, orange weathering, dark grey shale. This formationis considered to be of Lower Ludlovian age (Upper Silurian).,based on the graptolites formed here. The assemblage of fossils that have been collected from this locality are:

Desmograptus cf D. micronematodes var. Quebecensis (Ruedeman)

Plectograptus sp.

Monograptus colonus (Barrande)

Monograptus dubius (Suess)

Monograptus forbesi (Berry)

Monograptus tumescens var. contus(Berry)

One specimen of complete crinoid. sp. und.

Many small to large dapholopods.

Close observation of some of the bedding surfaces will reveal some interesting fossil ripple marks in a typical ridge and though configuration. These were probably produced by underwater currents rather than waves.

The topographic map to use for locality is the Ashland Quadrangle.